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the DASHEEN

A Tropical Root Crop for the South

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UNITED STATES DEPARTMENT OF AGRICULTURE
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the DASHEEN

A Tropical Root Crop for the South[1]

By W. H. Hodge, *principal botanist, Horticultural Crops Research Branch, Agricultural Research Service*

The dasheen is a tall-growing tropical plant with edible corms and tubers and closely resembles the elephantsear. It is a variety of the taro (*Colocasia esculenta* Schott), which has been a basic food plant in the Orient for 2,000 years and is now widely grown in the warmer parts of the Old World, especially throughout the islands of the Pacific.

Varieties of the taro came into the New World from two sources. Certain coarse, acrid types were brought into the colonies at an early date from tropical Africa along with the slaves who used it for food. Later a very superior variety was introduced into the West Indies from China. This oriental taro, now known as the dasheen, soon became a popular food plant in certain parts of the West Indies. Dasheens continue to be extensively grown in these islands. In the Lesser Antilles especially, they constitute a staple vegetable for the Creole population, providing an excellent tropical substitute for the white potato. Outside of the West Indies, the dasheen is little used in the American tropics. In Hawaii where the Oriental population is large, the dasheen is commonly grown, chiefly as a home-garden crop of the Japanese and Chinese (*3*).[2]

Dasheens have been grown commercially as a specialty crop in the Southern States since 1913, but they were cultivated experimentally several years earlier. The Trinidad dasheen is the horticultural variety of the oriental taro most commonly grown in the South. It is prolific and, when properly cooked, is rich and mealy and has a delicate, nutty flavor. In food properties it is very similar to the potato; but the dasheen contains less water, and as a result, its content of starch and protein is about one-half greater than that of the potato.

The name "dasheen" is said to have originated in Trinidad (*8*, *9*), but it is now commonly used in a number of English-speaking islands of the Lesser Antilles as well as in the Southern States. The word is believed to be a corruption of the French "de la Chine" (from China), indicating the supposed country of origin of this plant. The full name, originally used in the French-speaking islands of the Lesser Antilles, was probably "taro de la Chine" (Chinese taro) or "chou de la Chine" (Chinese cabbage) or something of similar meaning, but the first part of the name seems to have passed out of use in most places.

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[1] This circular contains much material formerly in Farmers' Bulletin 1396, The Dasheen; a Southern Root Crop for Home Use and Market, by Robert A. Young.

[2] Italic numbers in parentheses refer to Literature Cited, p. 27.

Oriental taros, probably identical with the Trinidad dasheen, are also grown elsewhere in tropical America under other vernacular names. In fact, there is a great deal of confusion in the common names applied to edible aroids in the Tropics. In Spanish-speaking areas of the Caribbean, dasheen-type taros are called "malangas," a name generally used in Cuba, Haiti, Puerto Rico, and Venezuela. The English names "eddo" and "coco" are sometimes used in Barbados and Jamaica.

The name "malanga" is also applied, especially in Cuba and Hispaniola, to species of the closely related, tropical American genus *Xanthosoma*, which includes the "yautias" of the Dominican Republic and Puerto Rico and the "tannias" (pronounced tán-yahs) of most of the Lesser Antilles. It is easy to see why these common names have been used interchangeably, for the genera *Xanthosoma* and *Colocasia* are superficially alike in habit. They can be easily distinguished, however, for *Xanthosoma* is characterized by nonpeltate leaves bearing a sinus open all the way to the petiole, while *Colocasia* is characterized by peltate leaves.

There are many more or less distinct varieties of taros that have the same general growth habit as the Trinidad dasheen. Because of the origin of the word "dasheen," however, it is better to call these varieties "taros" except when they are of known Chinese origin.

BOTANICAL DESCRIPTION

The dasheen is a member of the arum family (Araceae) (fig. 1), to which also belong such familiar plants as the calla (*Zantedeschia*) and the native American jack-in-the-pulpit (*Arisaema*). In general appearance it resembles the common ornamental elephantsear (*Colocasia antiquorum* Schott).

The underground parts of the dasheen (figs. 2 and 3) are clustered compactly and consist of one or more large, edible central corms and a considerable number of edible "cormels," or lateral tubers. Dasheen growers of northeastern Florida often call a corm by the colloquial name "mammy," while the "cormels" are simply known as "tubers." Both corms and tubers are usually somewhat ovoid, but the form varies with the variety and the length of the season.

Large whorled leaves are produced by each corm and usually by each of several tubers in a hill. As in all true taros (*Colocasia*), the leaf is peltate (the petiole, or leafstalk, attached near the center of the blade and not touching the sinus), erect, and 3 to 7 feet high under suitable growing conditions. The blade is ovate to broadly ovate, cordate, and dark-velvety green above; some varieties have a purplish spot at the point of petiole attachment. The petiole varies in color, according to the variety, from plain green to light or dark-purplish maroon in part or all of its length. The inflorescence is typically aroid in form, with a spadix borne within a yellowish, rolled spathe.

Dasheen varieties differ from most taros in having their corms and cormels practically free from the acridity so common to other aroids. This acridity is caused by bundles of microscopic, needlelike crystals of calcium oxalate which give an unpleasant, prickly sensation when eaten. Caution should be used in tasting uncooked dasheens, for there is always the possibility that an acrid taro of similar appearance has become mixed with the nonacrid variety. The acrid element is destroyed by cooking. **Dasheen leaves are extremely acrid and should not be tasted except when cooked as greens according to the special directions given (p. 23).** Lemon juice in a little water may be used as an antidote if raw leaves or corms are eaten or chewed accidentally (*9*).

Dasheen corms vary in weight from less than 1 pound to more than

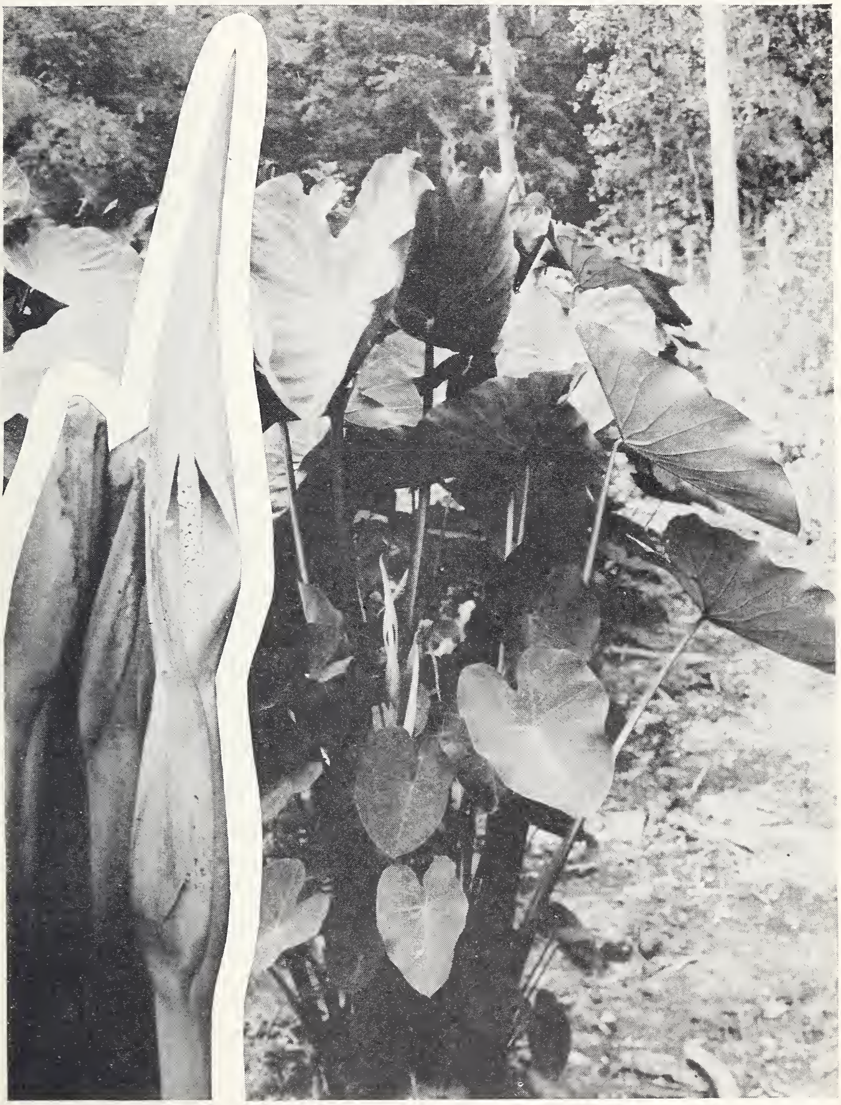

FIGURE 1.—A mature dasheen plant, 4½ feet tall, flowering in central Florida in August. The insert is a closeup of the inflorescence, showing the spathe and the tip of the spadix exserted naturally.

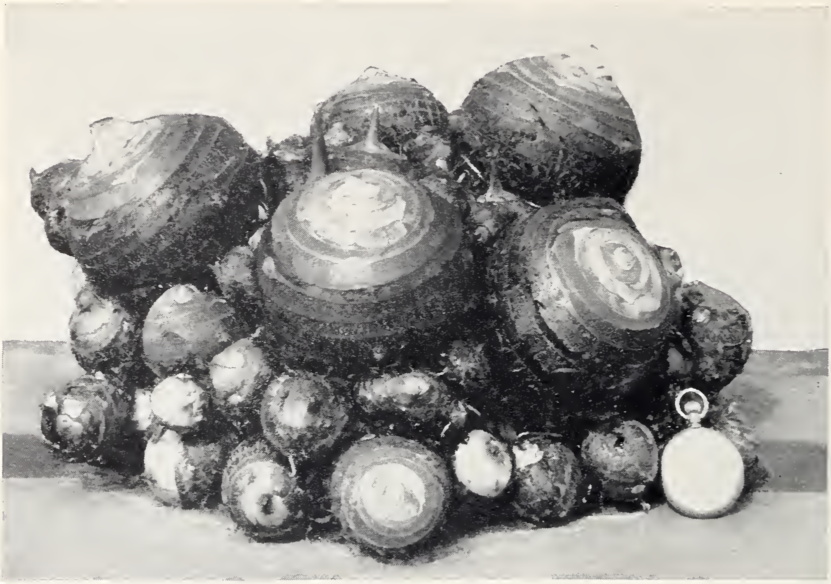

FIGURE 2.—A 23-pound hill of Trinidad dasheens before being broken up, showing the relative position of the larger corms and smaller lateral tubers (cormels) as they grew. This hill, which is much larger than the average, contains 5 corms instead of the usual 1 or 2.

8 pounds each, depending on the size and vigor of the plants. The tubers vary from less than an ounce to a pound or more each. One or more of these lateral tubers in each hill often attain the size of a small corm and also assume something of its shape and other characteristics. Such tubers are called secondary corms. A secondary corm results when a cormel, or lateral tuber, sends up leaves and gives rise to other tubers. It usually enlarges greatly toward the apex (bud end) and sometimes increases to more than half the size of the parent corm; it is commonly flattened on the side next to the parent corm. These secondary corms vary greatly in size and form, but in quality they always resemble the primary corm from which they arise, rather than tubers.

In general, tubers are superior in quality to the often coarser corms, and so are usually preferred by the trade.

The color of cooked dasheens just beneath the skin is purplish. The flesh of the corms and of any tubers that have sent up leaves is usually more or less tinged with violet, though occasionally it lacks this coloration. Violet-colored dasheens are often more rich in flavor than those of other color forms.

INTRODUCTION INTO THE UNITED STATES

The Trinidad dasheen was first introduced into the continental United States from Puerto Rico in 1905. The variety had been obtained originally from the British island Trinidad by the Federal Experiment Station at Mayaguez, Puerto Rico.

In 1908–09, field tests conducted in central Florida and near Charleston, S. C., demonstrated that this tropical crop could be grown successfully in the Southern United States. Dasheens have been grown as a specialty crop in the Deep South since 1913 (*8*, *9*, *10*, *11*, *12*, *13*). Early in 1914 it was learned that taros were being imported to supply the demand in big cities, such as New York, where large foreign-born populations were concentrated.

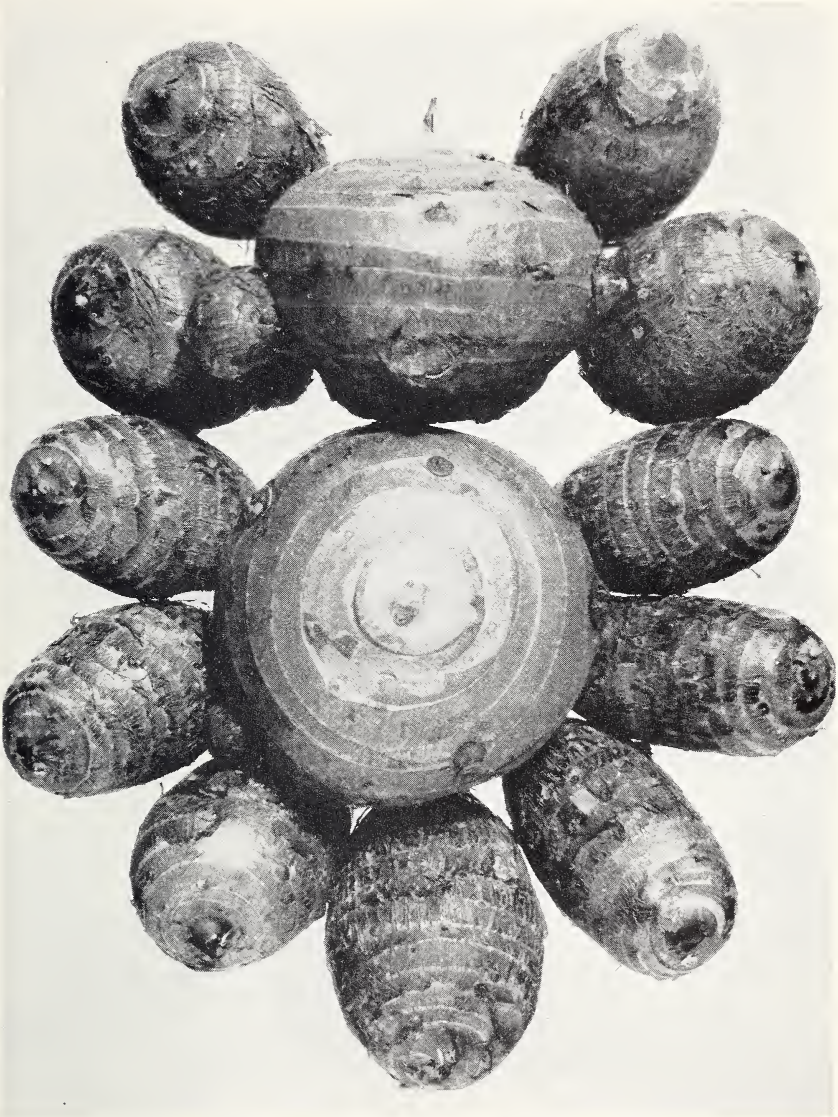

FIGURE 3.—Two dasheen corms and some first-grade tubers suitable for table use or market. (Reduced.) The lower corm is viewed from the top, the other from the side. The scar near the base of the latter indicates the point where a tuber was attached.

In 1919 a substantial import trade in fresh dasheens and other taros began to develop in the United States. The countries involved, in the order of volume of dasheens exported, included China, the Azores, Cuba, Hong Kong, Portugal, and the Dominican Republic. The first three accounted for five-sixths of all imports. In 1952 the ban on trading with Communist China eliminated that country as an exporter to the United States; but because of increased production by the other countries, there has been no great reduction in total imports. Cuba, for example, doubled her dasheen exports in 1952. Formosa, Spain, Japan, Malta, and Cyprus have now entered into the trade. During the period 1930–35, the imports averaged nearly two and a half million pounds a year; but more recently the quantity of dasheens imported annually has been considerably reduced, as shown by the following figures (*6*):

	Pounds	*Value*
1948	616, 814	$46, 332
1949	811, 622	79, 779
1950	732, 106	56, 427
1951	672, 717	47, 956
1952	665, 333	49, 176

Since the dasheen is a superior kind of taro, the question of substituting American-grown dasheens was taken up with the importers. Their cooperation was obtained in helping to increase dasheen production in the South. A regular market demand for domestic dasheens was developed, and by 1920 about 10 carloads of this root crop were being shipped annually. The young industry was centered near the towns of Callahan and Hilliard, in northeastern Florida, not far from Jacksonville. Here the growers organized a cooperative about 1923, to insure better grading and better prices for the new crop. Today this section is still the principal domestic center of dasheen production. A smaller production center, which developed in Effingham County, Ga., north of Savannah, is no longer active.

In the early years of foreign competition, domestic growers were unable to compete with the low prices of imported dasheens. Production of domestic dasheens therefore dropped considerably.

Since the end of World War II, the reduction in imports has been a boon to domestic dasheen growers, most of whom can now market their crop at a reasonable profit. In general, domestic dasheens are of superior market quality and obtain premium prices (see p. 19). It is thus possible for domestic dasheens, selling at present for about 10 cents a pound, to compete successfully with the imported ones. The current cost at the port of entry of the fresh imported product, including duty of 25 percent (20 percent for the Cuban product), ranges roughly between 8 and 9 cents a pound—usually nearer the upper figure.

PROSPECTS FOR GROWTH OF THE INDUSTRY

As in earlier years, the principal consumers of dasheens in our northern cities are still the people of oriental or West Indian origin; and there has recently been a rapid growth of the West Indian population in such cities as New York. These people naturally continue to demand the basic foods to which they have been accustomed. This foreign-born population should continue to support a large portion of the dasheen production in the United States, so long as a premium grade is provided.

Many native-born citizens of the United States, other than those of West Indian or oriental stock, have become acquainted with the dasheen since its introduction into the South as a specialty crop. However, in order to compete with more familiar root vegetables—especially the staple potato—the dasheen would have to be supplied to the market more regularly and in more attractive grades.

Lengthening the season during which dasheens are available by properly storing the surplus as soon as the crop is harvested and cured is a means of increasing dasheen consumption each year. In the South, where the temperature is often too high for ordinary storage, part of the commercial crop is usually left in the hands of the growers until sprouting or partial decay takes place. As a result, a satisfactory supply is not ordinarily available for the usual late-winter and early-spring demand. However, dasheens can be handled and stored so as to keep well without sprouting, at least until late spring (see p. 18). If the industry is to grow, the vegetable should not only be placed on the market as early as possible, but it should be kept there in first-class condition during the season, and the season should be prolonged by correct storage methods.

Dasheen chips (see p. 27) have been manufactured on a limited scale and have proved popular in parts of Florida. This suggests the possibility that manufacture on a larger scale of chips, crisps, and similar products would stimulate the industry. Such larger enterprises should be located near the dasheen-growing sections, where the manufacturer could obtain dasheens of desirable grade and also avoid expensive transportation of the raw product.

VARIETIES

Numerous oriental taros of the dasheen type have been tested by the United States Department of Agriculture and reported on (*12*). Only three varieties—the Trinidad, the Sacramento, and the Ventura—have been recommended to growers. Of these the Trinidad has proved the most popular, being the most prolific and producing corms as well as tubers of high edible quality. At present the Sacramento appears to be increasing in popularity among some commercial growers because of its larger, more uniform tubers, but in this variety the corms are more variable in quality and hence not always marketable. Descriptions of the three varieties follow:

Trinidad (*P. I.*[3] *No. 15395*).—From the island of Trinidad, British West Indies. Leaves erect, 5 to 7 feet high; blade broadly ovate, cordate, rather dark velvety green above, with a purplish spot at the point of petiole (leafstalk) attachment, light green beneath; petiole dark green, shaded with numerous bronze or maroon lines—especially on the lower half—and with solid reddish maroon on the shoulder (next to the blade). Corms (see fig. 2) roughly ovoid to nearly spherical; tubers (fig. 4) ovoid to long or irregular; buds reddish or pink; flesh white. Each hill produces from 1 to 5 corms and from 20 to 100 tubers. From 5 to 10 of the tubers give rise to a whorl of leaves, as does also each corm. When the corms are properly grown and cooked, the flesh is mealy, rather dry, chestnut-flavored, and is cream-colored, grayish, or violet. When the tubers are cooked, they are slightly more moist, lighter in shade, and finer grained than the corms, though often less rich in flavor. This variety is very prolific, ordinarily yielding 250 to 350 bushels per acre in good soil. The yield per hill commonly varies from 4 to 10 pounds of cleaned corms and tubers. In unusually rich and deep sandy loams, yields of 20 to 30 pounds from single hills have been recorded.

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[3] P. I. refers to accession number of Plant Introduction Section.

Sacramento (*P. I. No. 47002*).—Obtained in 1913 from a Chinese merchant in Sacramento, Calif. Leaves practically identical with those of the Trinidad, but fewer are produced from lateral tubers. The buds of corms and tubers are more reddish than those of the Trinidad; the corms are usually larger and more regularly ovoid or roundish. This variety produces about 10 to 15 lateral tubers (fig. 5) to the hill—fewer than the Trinidad—but the average size of the tubers is considerably larger and they are more uniform in size and shape. The corms are variable in quality, sometimes good, but usually too unreliable for market purposes. The tubers contain more moisture than those of the Trinidad and are usually not quite so rich in flavor; but they are whiter when cooked, are of pleasing table quality, and become even better in storage. Their relatively large size and uniform shape commend the Sacramento dasheen for cultivation when there is no definite intention of marketing the corms.

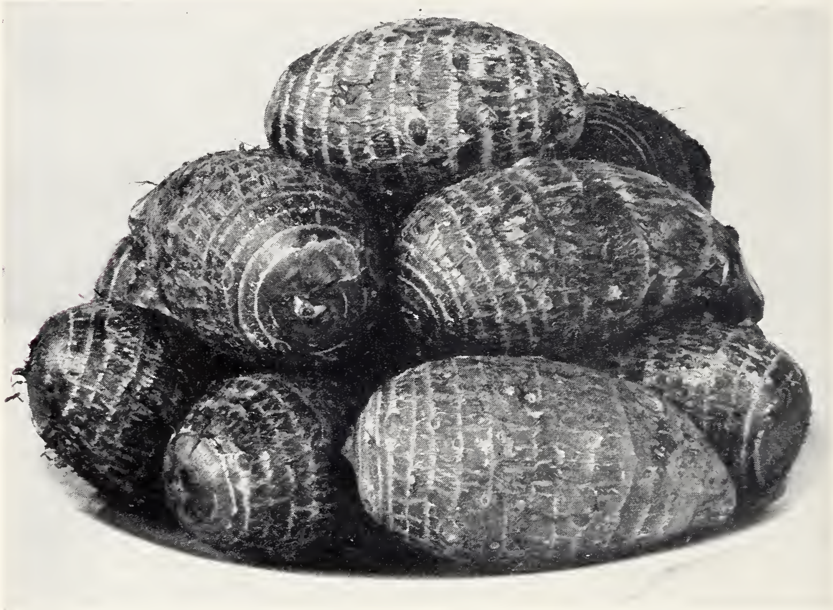

FIGURE 4.—Properly cleaned, strictly No. 1 grade, Trinidad dasheens, ready for market. (Reduced.) These tubers, weighing from 4 to 7 ounces each, are ideal for most culinary purposes. Usually less than one-fifth of the tubers are as uniform.

Ventura (*P. I. No. 47003*).—Obtained in 1916 from a grower at Ventura, Calif., who had obtained it several years earlier from a local Chinese gardener. Leaves similar to those of the Trinidad variety, but bases of petioles much more reddish. The buds of both corms and tubers are deep red, similar to those of the Sacramento. The corms are slightly smaller than those of the Trinidad variety, but more regular in form; the tubers (fig. 6) are about the size of the average Trinidad tubers, but fewer and usually more uniform in size and shape. The quality of corms and tubers is excellent and is scarcely distinguishable from those of the Trinidad.

CULTIVATION

The dasheen is a long-season crop, adapted for culture only in regions where there is normally a very warm, frostless season of at least 7 months. It needs a rich, loamy soil, abundant ground water, good drainage, and a fairly moist atmosphere. Soils lacking fertility or

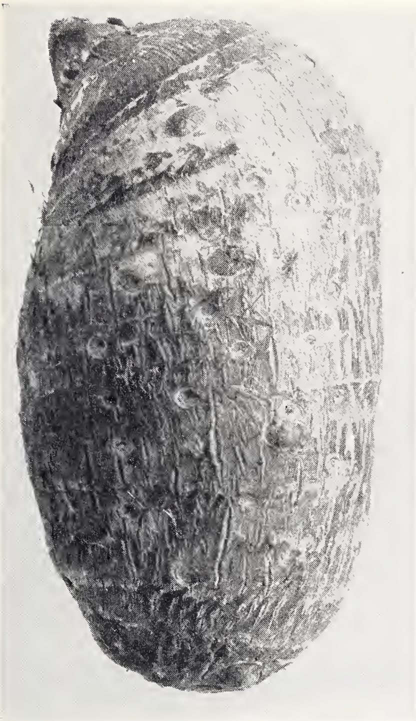

FIGURE 5.—A typical tuber of the Sacramento dasheen, weighing 6½ ounces. × ⅔.

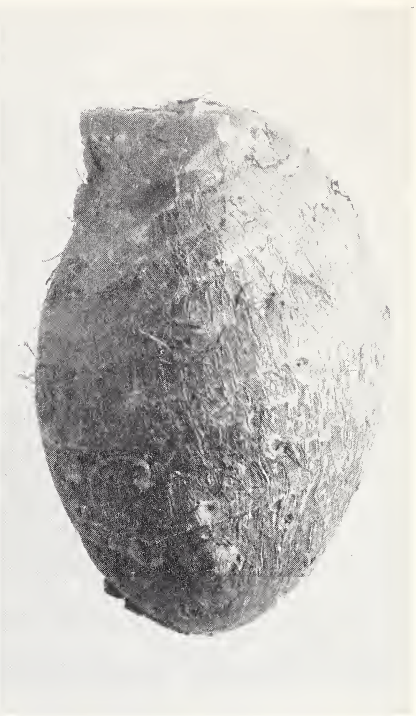

FIGURE 6.—A 4½-ounce tuber of the Ventura dasheen. × ⅔.

moisture give reduced yields, while poorly drained soils produce dasheens of such inferior quality that they are often unsuitable for table use. A crop is not greatly injured, however, by occasional flooding for short periods.

As a commercial crop in the continental United States, the dasheen is therefore limited primarily to lands that are comparatively low on the Coastal Plain from South Carolina to eastern Texas, though it can also be grown in certain parts of California.

Soils similar to those of the hammock lands of Florida are especially suited to this crop. Hammock soil is a rich, sandy loam, underlain with clay. When properly drained, some types of muck land, like parts of the Florida Everglades, yield large crops of dasheens of fair to good quality. Flourishing crops can be produced on new land the first year. To produce such crops, it is not necessary to place lime on the soil, though its application increases the yield.

Planting should be done as early as climatic conditions permit—2 weeks or more before the last spring frost is expected. Where the frostless season does not exceed 6 months, it is well to start the tubers a month earlier indoors and set out the plants when danger from frost is past.

Unfavorable weather conditions often lower the quality of the crop by destroying the mealy-cooking character. For example, a long drought in the late summer, followed by renewed growth of the dasheens or by a prolonged wet period during the fall without adequate drainage, may make the crop practically unmarketable for food purposes. The corms are the more seriously injured in quality, though the lateral tubers are somewhat affected. The size of the crop is also reduced.

Dasheens are planted much like potatoes; they require the same soil preparation and are covered at the same depth. The seed corms or tubers, however, are planted whole. Tubers weighing from 2 to 5 ounces each are best for planting, but good results may be obtained with much smaller ones if the soil conditions are favorable. It has been demonstrated that there is no advantage in selecting tubers of superior form, as far as the resulting crop is concerned.

For field culture, tubers or small corms are planted whole and singly, not more than 2 or 3 inches deep. The top portions of medium-sized or large corms, if available, produce strong plants. Tubers or corms with the terminal buds living are preferable for planting unless it is desired to increase the number of corms. If the terminal bud of the tuber or corm grows, one new corm results; if the terminal bud fails to grow, two or more lateral buds usually start, and each becomes a corm. Each new corm then gives rise to lateral tubers.

It is recommended that dasheens be planted in 3½- or 4-foot rows, about 2 feet apart in the row. Such spacing gives good yields; and the plants, when mature, effectively shade the ground, thereby reducing the labor of weeding.

Reasonably deep cultivation of dasheens in the early part of the season is beneficial if soil moisture is sufficient; but from midsummer on, the soil should be hilled around the plants and the ground kept free from weeds by frequent but extremely shallow cultivation or

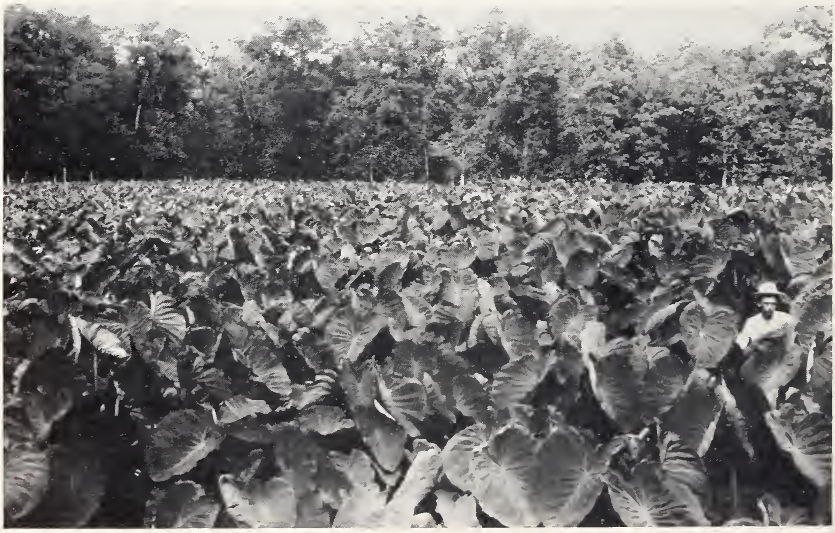

FIGURE 7.—A field of Trinidad dasheens in central Florida in August at the height of vegetative growth. The plants are spaced 4 by 3 feet (they can be planted closer) and vary from 5 to 7 feet in height.

hoeing. The dasheen is shallow rooted, and the crop is easily injured if the surface roots are disturbed. When a few plants only are grown and a maximum yield is desired, mulching with dry grass or any kind of litter may be practiced in dry weather to conserve the soil moisture.

Planting dasheens early in February has given good results as far north as the northeastern coast section of South Carolina. A satisfactory method is to turn a 4-inch furrow over the tubers from each side when they are planted, leaving a ridge over the row. About April 1, or when the weeds have just sprouted, the ridges are broken with a harrow. A second and even a third harrowing can often be given before the dasheen plants are large enough to be injured by this method of cultivation. Clean cultivation is practiced until August.

In the hammock lands of central Florida, dasheens planted about March 1 should be ready to harvest in November.

Under average conditions the plants reach a height of 4 to 5 feet in midsummer, and on favorable sites they may grow to 7 feet. Where frost does not occur after April 1, it is often possible to obtain dasheens for home use early in September, but under normal circumstances the main crop matures in October or November. The corms and tubers do not begin to develop rapidly until August, at which time the plants reach maximum height (fig. 7). Concurrent with tuber formation and long before frosts occur, the leaves start to die back slowly; this process continues until, by November, little of the original foliage remains (fig. 8). The harvesting of the main crop should be deferred until the first frost or, better still, until all growth has ceased and the older leaves die. If the crop cannot be harvested immediately, it will keep perfectly in the ground, in the

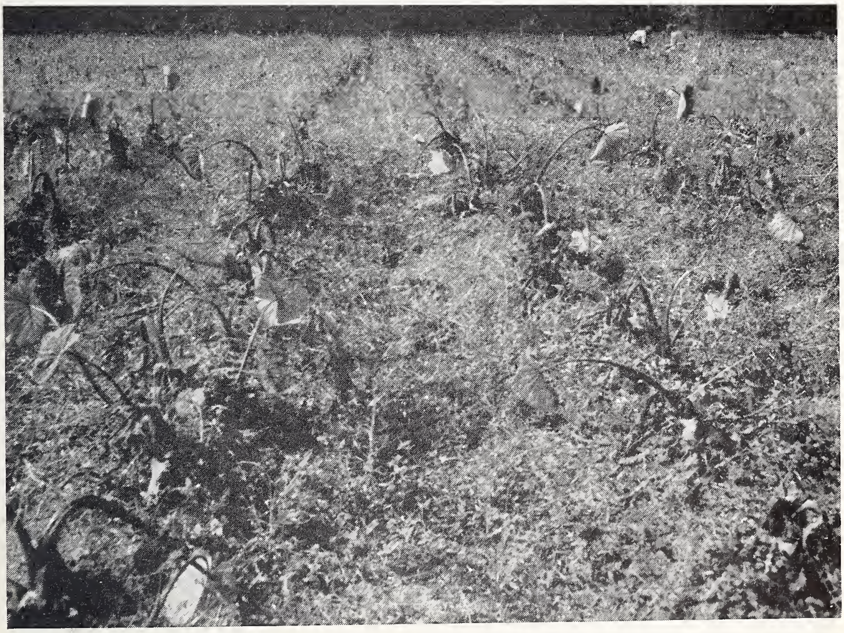

FIGURE 8.—A field of dasheens in northern Florida in November, at the appropriate time for harvest. The foliage has died back, and the tuber crop is mature and ready to be dug.

latitude of northern Florida—regardless of rain or cold—until early spring, when the corms and tubers will begin to sprout.

FERTILIZING

An abundance of humus in the soil is essential for successful dasheen culture. For this reason the turning under beforehand of a soiling crop, preferably a legume, or of a liberal quantity of well-rotted barnyard manure at planting time is advised when practicable. This may be supplemented, especially when a good supply of manure is not available, by the application of a commercial fertilizer of high potash content. In most soils suited to dasheens, the use of a standard fertilizer such as 4–8–5 or 5–8–5 is justified by the increased yields. Two applications, each at an average rate of 700 pounds per acre, have proven ample. The first application may be drilled in the rows at the time of planting while the second can be given as a sidedressing during cultivation in early June or before the plants are 2 feet high. Unleached hardwood ashes may also be used, at the rate of 1,000 to 1,500 pounds per acre, if there is a shortage of potash from other sources.

HARVESTING

DIGGING

In the vicinity of Jacksonville, Florida, and in other dasheen-growing districts of about the same latitude, harvest dates for dasheens extend from the end of October into December. A good indication of the proper time for harvest is the condition of the leaves. When they have died back almost completely, the crop is fully mature (fig. 9).

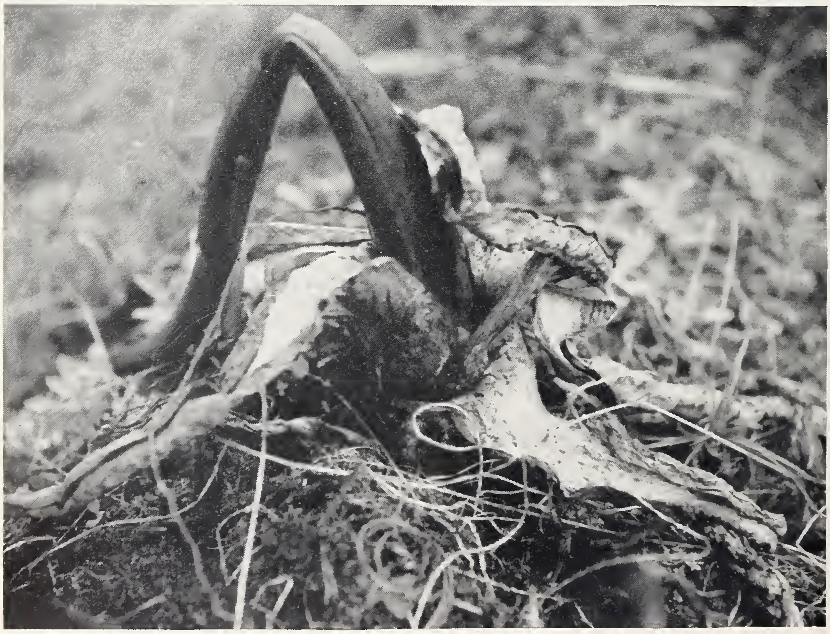

FIGURE 9.—A single hill of dasheens, fully mature and ready to harvest.

It is best to let dasheen plants mature well before harvesting the crop. The corms and tubers increase in weight during the maturing process, evidently by assimilating food materials from other parts of the plants. Digging and cleaning become easier because of the dying of the leaves and especially of the feeding roots. More important still, the crop normally keeps better in transit or in storage if the plants are mature.

Harvesting dasheens is more costly than harvesting potatoes because of the hand labor required in separating, cleaning, and sorting. A 10-inch plow has proved satisfactory for turning the plants over (fig. 10) when the field is large enough to justify its use. If the crop is not heavy, an 8-inch plow may be large enough. If the plants are mature, average hills are easily lifted with a mattock or a potato fork (figs. 11 and 12).

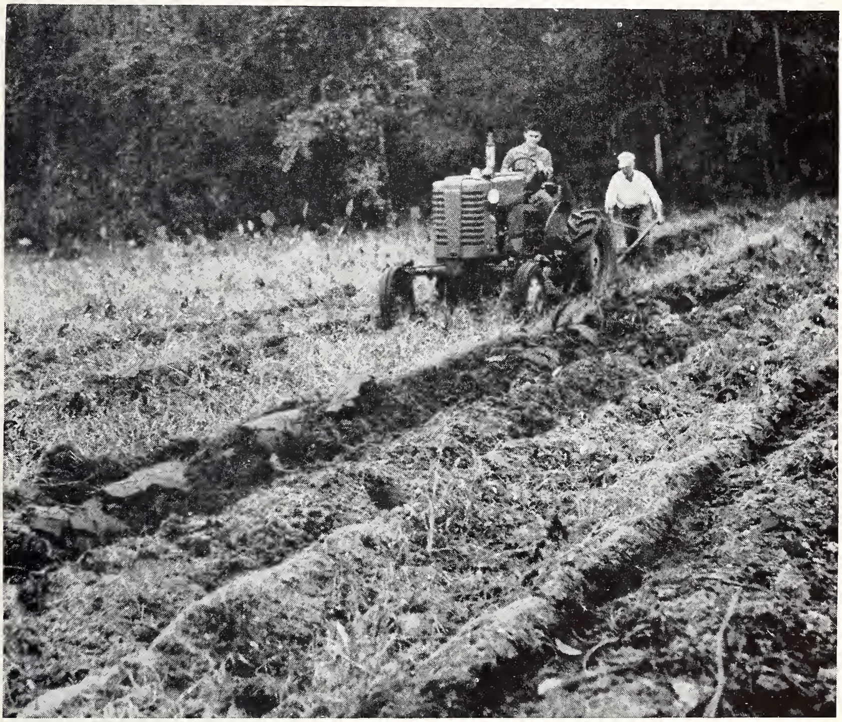

Figure 10.—Turning over dasheens with a tractor-drawn plow at Callahan, Florida.

Hand digging is preferable to plowing if the field is small, or if root knot (p. 20) is suspected and tubers from disease-free hills are to be selected for seed purposes. A furrow may be turned away from one or both sides of the row to facilitate digging by hand.

Some growers cut off the tops within a few inches of the ground before digging the crop, but that is not recommended, for benefits that may accrue from letting the tops dry while attached are lost.

Even on rather sandy land, if the plants are dug before they are fairly mature, the numerous fibrous roots and the firm attachment of

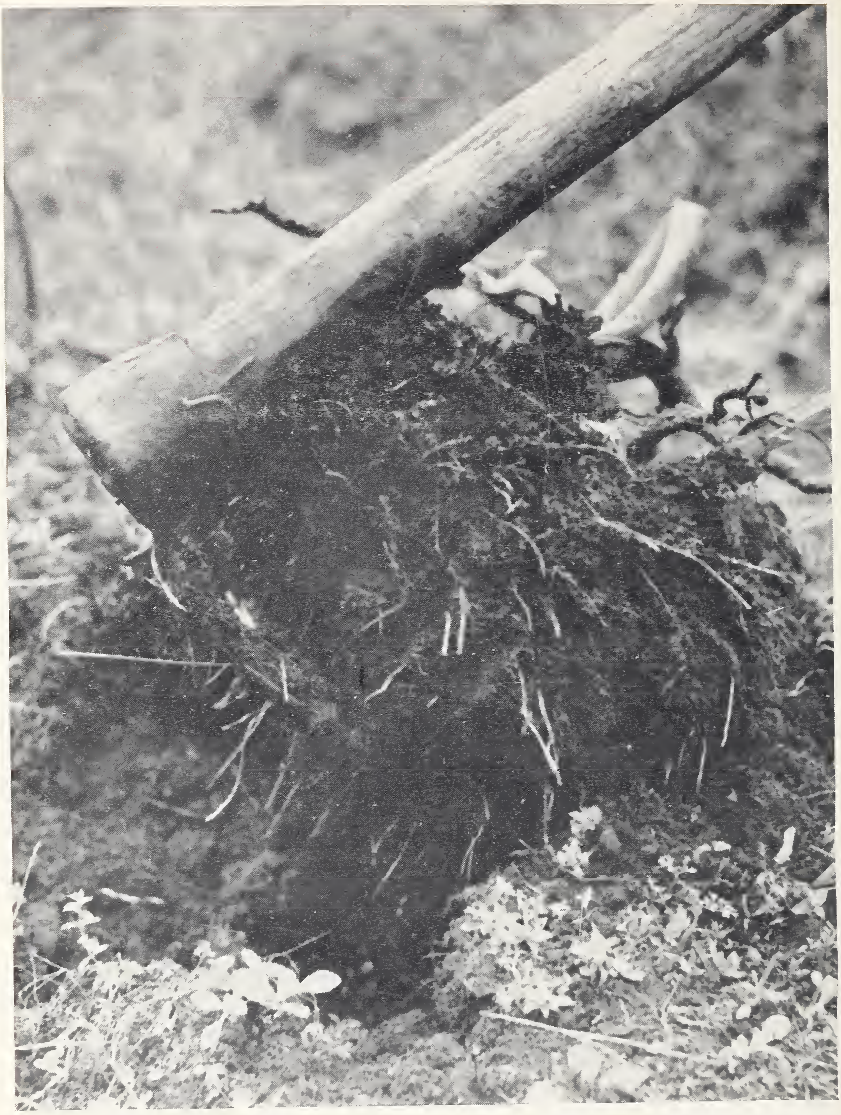

FIGURE 11.—Lifting a single, fully matured dasheen clump with a mattock.

tubers to the central corm combine to hold the soil so firmly that a clump of dasheens cannot be separated easily by hand. If the tops are still attached, these may be grasped and the clumps thoroughly shaken to dislodge as much soil as possible; they can then be broken apart by means of the tops. A potato fork cannot be used to break the clumps without injuring many of the best corms and tubers. The slightest injury permits the entry of rots that are always present in the soil.

The crop should be harvested in dry weather, if possible, for it is important that the tubers dry thoroughly in open air before they are

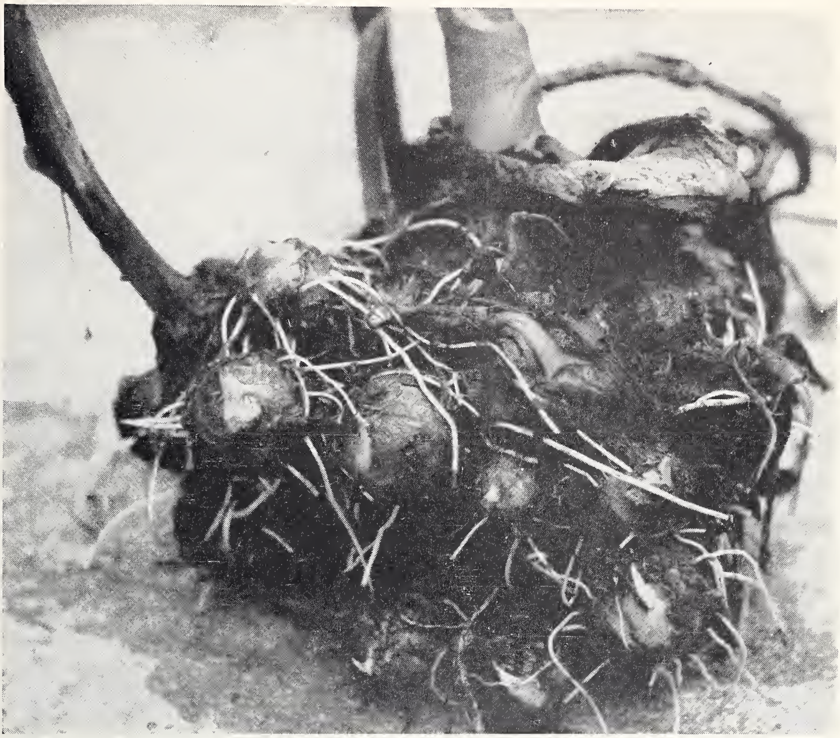

FIGURE 12.—The dasheen clump in figure 11 after washing, illustrating the relative position and number of tubers, as well as the mass of feeding roots which had died back by harvesttime, making digging and cleaning easier.

shipped or stored. If the sun is too hot, the dasheens with tops attached may be left to dry on the ground from 1 to 3 days (fig. 13). Drying or curing in the field makes cleaning easier; the tops and feeding roots become more or less withered and so are much more easily removed than when the plants are first dug. The packing or storing of dasheens without adequate drying or curing is likely to result in considerable loss from storage rots.

The dug dasheens should not, however, be exposed to frost. If they cannot be dried in the open because of weather or other circumstances, they should be given free ventilation under cover for a week or more before they are placed in closer quarters.

YIELD

The corms, usually of marketable size if in good soil, constitute from one-third to more than one-half the yield of a hill of dasheens, while the tubers suitable for market constitute only one-eighth to one-half the total weight. A single hill often produces a peck of corms and tubers, while overall yields may run from 200 to 350 bushels per acre. With a total yield of 250 bushels per acre, the marketable crop therefore may be from 100 to 150 bushels, depending in part on the closeness of grading. The remainder, sometimes as much as half the yield, consists of tubers unsuitable for market because of unsatisfactory size or shape. As a rule, the larger the yield, the higher the proportion of first-grade tubers. With a low rate of yield, there may be almost no tubers of this grade and very few corms large enough for market. This fact emphasizes the importance of securing as heavy a yield as possible.

TESTING FOR QUALITY

Before shipping any dasheens, the growers—especially those who have had relatively little experience with this product—should make cooking tests on a number of corms and tubers from different parts of their fields as soon as the crop is sufficiently mature, to make certain that the dasheens are of suitable table quality. This testing should never be delayed later than the beginning of harvest.

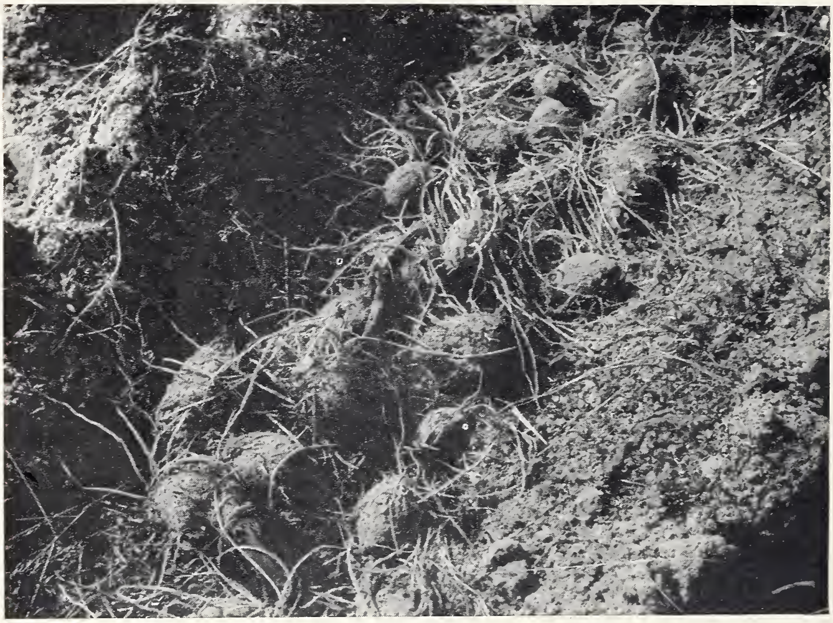

FIGURE 13.—Freshly dug dasheens drying in the field prior to cleaning.

It is the general practice of wholesale buyers to accept dasheens, especially corms, subject to routine cooking tests of samples selected by them. Boiled or baked dasheens are prepared in the same manner as potatoes; and whether boiled or baked, the corms and tubers, when cooked, should be mealy if immediately cut or broken open. Corms recently dug should be cooked by baking, or by parboiling and then baking, to keep them from splitting open and becoming water soaked. (See *9* and *13*.) Dasheens that are not mealy and of good quality when boiled or baked should not be marketed for human consumption. Shipping poor-quality dasheens would seriously injure the market for this product.

The most common cause of poor dasheen quality is deficient drainage of the land. This is especially noticeable in stiff soils containing large proportions of clay. Prolonged drought, with dying back of the tops followed by renewed growth of the plants, may also result in poor quality.

CLEANING

Dasheens are normally cleaned in the field after several days of drying. They are cleaned by hand and usually on the ground (fig. 14). When the weather is inclement or when frost threatens, the tops may be cut or roughly broken off, the soil removed, and the dasheens carried in trays to a shed or other shelter for further cleaning.

To be acceptable for market, dasheens should be well cleaned. The bases of the leafstalks should be entirely removed from all corms and tubers that have borne leaves, and all feeding roots and most loose fiber should be cleaned off. It is not necessary to remove every particle of fibrous matter, but enough should be taken off to make the dasheens attractive for market. (See fig. 4.) Reasonably thorough cleaning also lessens the danger of overheating and decay by permitting better air circulation among the dasheens during storage or shipment.

When dasheens are to be stored by the grower, the bases of the leafstalks may be left attached, if desired, until the dasheens are used or shipped. The remains of the tops, however, must be allowed to dry out thoroughly beforehand, and the dasheens must not be stored in too deep a layer or with poor ventilation.

Material to be used for seed stock is usually not cleaned by growers because cleaning might damage the buds; and the uncleaned stock should not be piled on shelves for any length of time because of danger of dry rot. Instead, especially in milder areas, seed tubers may often be stored on the ground in a sheltered place—under a tree, for instance—and protected by a covering of straw.

GRADING

It is usually best to grade dasheens when they are cleaned. (See fig. 14.) No satisfactory mechanical grader has been devised. Marketable dasheens are held apart from those to be used for seed stock.

In preparing dasheens for market, their external appearance is as important a consideration as their quality. (See Cleaning, above.) Very small corms, such as those from stunted plants, should never be marketed for table use. Such corms may lack the mealy-cooking character that is essential in dasheens for human consumption.

Strictly first-grade tubers (see fig. 4) are ovoid and smooth, and they weigh from 4 to 8 ounces each. In addition to first-grade tubers, the standard market grade may contain small proportions of tubers as small as 3 ounces each if they are perfectly formed, and also slightly irregular ones weighing from 4 to 10 ounces each. However, no extremely small tubers of any shape and no decidedly poorly shaped ones of any size should be included in the standard market grade.

Opinion differs as to whether corms and tubers should be mixed in a lot of dasheens intended for the market. The wisdom of mixing

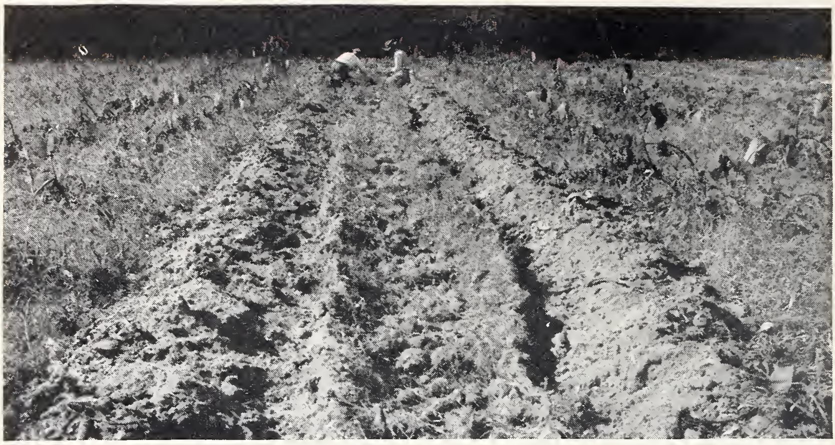

FIGURE 14.—Cleaning and grading dasheens in the field by hand.

them would depend on whether they are to be consumed in a few weeks or stored for a longer period. Corms do not keep so long as tubers. It is usually better for the growers to keep them separate while in their own hands, although there is no serious objection to mixing them in shipment if the purchaser so desires.

Trinidad dasheens are usually of three grades: (1) Ovoid tubers not smaller than 3 ounces each and medium-sized secondary corms of good shape (see figs. 3 and 4); (2) corms of all sizes suitable for market, including large secondary corms; and (3) all tubers smaller than 3 ounces, poorly shaped tubers or secondary corms of all sizes, and the very small or stunted corms. Seed dasheens may be selected from the third grade of Trinidad dasheens. The remainder of this material is used for the home table or for stock feed.

The uniformity of the Sacramento dasheens makes it impossible, as a rule, to separate the corms from the tubers.

STORAGE

Dasheens can be stored successfully at 50° F. with ventilation. Tubers keep better than corms, and the corms should therefore be used or otherwise disposed of as early as practicable. Tubers have been kept for nearly 6 months (from early December to late May), unsprouted and with only slight loss from decay, in a dry basement where the temperature ranged mostly between 40° and 55°. The importance of ventilation in reducing loss from storage rots can hardly be overemphasized.

Dasheens withstand temperatures near the freezing point for a short time without apparent injury; and the wide fluctuations of temperature during the winter in Florida in any ordinary storehouse or other building do not seem especially injurious unless the heat becomes sufficient to induce sprouting. However, a curing period at harvesttime of several days with free ventilation is essential for successful storage in quantity. (See pp. 14–15 and fig. 13.)

Another method of storing dasheens when the quantity is not too large has been used successfully in the South. The entire clumps are lifted after frost, with the bases of leafstalks, roots, and soil still attached, and placed close together under an open shed. When necessary, they are covered with soil as a protection against freezing. Both corms and tubers keep perfectly under these conditions while the weather remains cool.

MARKETING

The market for domestic dasheens is limited at present because only a small part of the population is familiar with this vegetable and also because of the competition from dasheens imported at low prices.

The necessity for establishing an adequate market is vital to a large grower; and if he expects to cultivate a profitable crop, he should become thoroughly conversant with what constitutes good quality, favorable appearance, and proper packing of his dasheens.

After a curing period of a few days, a bushel of dasheens weighs about 60 pounds, but the weight gradually diminishes through further loss of moisture to between 50 and 55 pounds. This puts the late shipper at a disadvantage unless he obtains a higher price per pound.

Current prices of dasheens are favorable to growers, with tubers bringing 10 to 11 cents a pound and corms averaging 4 cents a pound. As a rule, corms are more difficult to dispose of than tubers.

When lower prices have prevailed, they have proved ruinous to growers, largely because of heavy imports of dasheens and other taros at costs at least as low as domestic quotations. Wholesale prices previously received by growers for well-cleaned, grade 1 dasheen tubers have ranged from 4 to 5 cents a pound in the early years of the industry down to 2½ cents or less in later years; and for field-run stock, including all except the extremely small corms and the unusually small or poorly shaped tubers, from 3 cents down to 1½ cents a pound.

Because of present conditions in the Orient, imports of this root crop from that region have practically ceased, while dasheens and taros imported from tropical America have proved to be of lower quality than the domestic product which has been much in demand.

PACKING AND SHIPPING

The freight rates on dasheens are the same as on potatoes. Like potatoes, dasheens are most commonly and economically shipped in burlap sacks normally holding 100 pounds but packed 105 pounds to allow for normal loss of weight during transit. Motor freight is the most frequently used carrier.

Dasheens can also be shipped in barrels. Though more expensive than sacks, they furnish protection from bruising and, if fairly tight, provide some protection from freezing. Standard barrels holding from 160 to 180 pounds are preferable.

Containers other than barrels or sacks may also be used for dasheens. A strongly constructed bushel basket makes an attractive and convenient package and is especially useful for express shipment of fancy dasheens to small dealers or individual consumers. Some growers may find it worthwhile to clean and grade their product with extra care, to brand the baskets with their own marks, and to ship this type of package to wholesalers. A standardized product would simplify the distribution problem for the wholesale merchant and, at the same time, insure to the careful grower recognition of the excellence of his dasheens.

DISEASES

Dasheen plants appear to be subject to few diseases. Of the known diseases, one is bacterial while the other, known as root knot, is caused by nematodes. Thus far only root knot has become particularly serious.

ROOT KNOT

The common root-knot nematodes attack both the feeding roots (fig. 15) and the tubers (fig. 16) of the dasheen, causing characteristic knots, or galls, on the roots and wartlike swellings on the tubers. The galls interfere with the nutrition of the plant and ultimately kill the part of the root beyond the gall. The swellings, or "sores," distort and stunt the tubers. When the nematode infection is severe, it not only renders the tubers unfit for market but also makes them more subject to decay in storage.

Dasheen plants that are badly infected with root knot often have

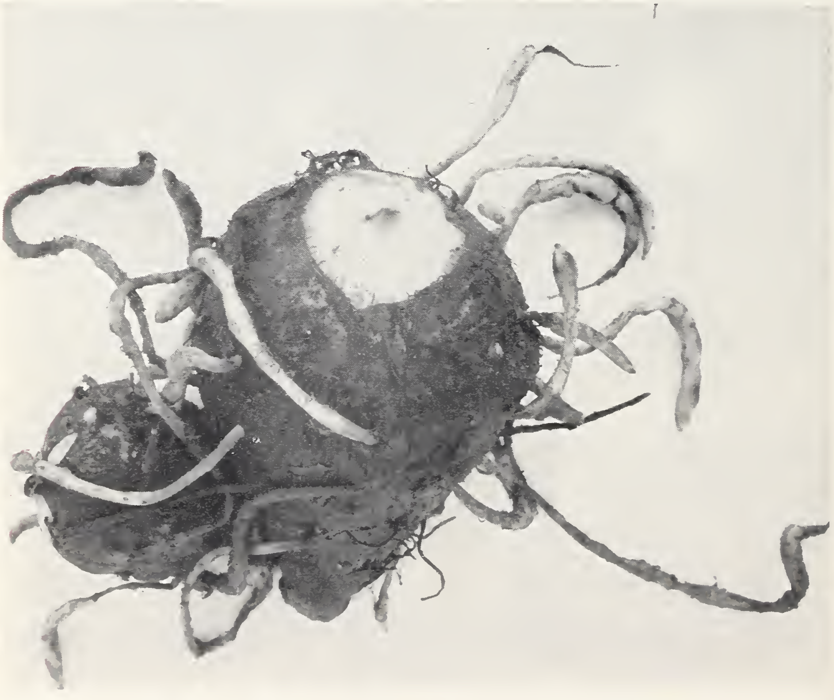

Figure 15.—Dasheen tubers (reduced) with the attached feeding roots badly diseased with root knot. The swellings indicate where one or more nematodes are developing. The tubers themselves, in this instance—because of excellent growing conditions and perhaps light original infection—do not show marked injury.

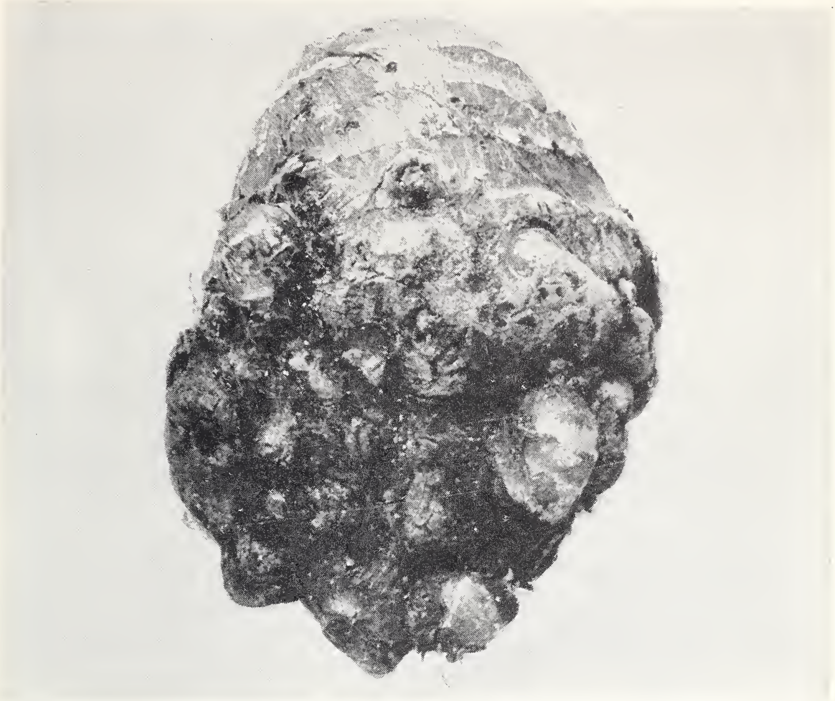

FIGURE 16.—A small dasheen tuber (natural size) distorted by severe nematode infection. The numerous swellings on the lower half are caused by colonies of nematodes. Compare this tuber with smooth, healthy ones (see fig. 4).

stunted leaves, especially where the soil is light and infection has taken place early in the season. Generally speaking, the lighter the soil, the more severe are the effects of root knot. The disease can be controlled by selecting seed tubers only from land that is known to be free from root-knot infestation at time of harvest and planting them in land that is free from the nematodes. Each grower should save his seed tubers from his own plants, provided he can grow them on uninfested land.

Dasheens slightly diseased with root knot may be treated with hot water (122° F.) to kill the nematodes while the tubers are dormant, without seriously affecting the vitality of the tubers. Any tubers intended for seed that are even suspected of being infected with nematodes should be treated, especially if they are to be planted in land not known to be already infested. Directions for treatment are as follows:

> Immerse the tubers for a period of 40 minutes in water kept at a temperature of 122° F. If the temperature of the water falls below this for more than a few moments, the nematodes may not be killed; and if it rises above 126°, the tubers may be injured.
>
> A rather large volume of hot water is desirable, and an accurate thermometer should be kept suspended in it so that the temperature can be determined instantly at any time during the treatment. The temperature may be regulated by keeping a low fire under the vessel, or by adding hotter water when needed and cold water when the temperature rises above the danger point.
>
> Dasheens should be treated while dormant, since after they begin to sprout they

are more easily injured by the hot water. For this reason, unless they are planted extremely early, it is advisable to treat the tubers several weeks in advance of planting.

To avoid danger of introducing the root-knot nematodes into land not already infested with it, all dasheens to be planted should be treated as above unless they are known to have been carefully examined at the time of digging and the fibrous feeding roots have been found free from all evidence of this disease. To be of value, this examination should be made when the roots are fresh, for it is only then that the characteristic knots, galls, and swellings are easily and certainly recognized. Examination of the tubers at any other time is useless unless the nematode infection is severe enough to cause distortion. The nematodes causing root knot are minute eelworms. The larvae and the males are not usually seen without a lens, but the adult females are as large as a pinprick and can be seen as glistening white bodies when a gall is broken open. Their presence is usually recognizable by swellings on the roots and tubers. When the disease is severe, most of the fibrous roots of the dasheen are noticeably swollen at one or more places, a condition caused by colonies of nematodes within the roots at those places. When the disease is advanced, many of these roots rot off at one of the swellings, leaving the stubs attached to the tubers. Usually, some of the lateral tubers from such plants become distorted in shape and unhealthy in appearance, because of the nematodes in them; these tubers often decay within a few weeks if stored. Such severely infected tubers should not be used for planting, even if treated.

It is advisable to plant dasheens only on land that is free from root knot, when this is possible, or else on land that has been rotated for one or more years with root-knot-resistant crops. What crops are both resistant and suitable to the particular area can best be determined by consulting the State agricultural experiment station in that area.

Infested land can be cleaned of infestation by soil fumigation. For information on this subject, the State stations should also be consulted.

STORAGE ROTS

When dasheens are stored before they are dried out or cured sufficiently, they may be attacked by storage rots. Careful handling, adequate curing in open air before storing, and proper temperature and ventilation of the storage place prevent serious loss from these causes. (See p. 18.)

USES AS A VEGETABLE

The dasheen has three different uses as a vegetable: The corms and tubers, which contain principally starch and protein, are used like potatoes; the leaves, especially the young green leaves and leafstalks, can be cooked as greens provided the acridity is destroyed (see p. 23); and the blanched young shoots, obtained by forcing corms in the dark, furnish a tender vegetable having a flavor somewhat like that of mushrooms.

For detailed recipes for each of these products, see (*13*).

CORMS AND TUBERS

Dasheens of good quality, when well cooked, are mealy and have a delicate, nutty flavor. They are drier and firmer than potatoes, containing about one-half more of nutrient materials. The flesh may remain white when cooked or may become cream colored, grayish, or violet; the corms usually become darker than the tubers. The corms (see figs. 2 and 3) commonly weigh from ¾ of a pound to 3 pounds each, though occasionally they are much larger. Grown under proper conditions, the corms when cooked are somewhat drier, more mealy, and richer in flavor than the lateral tubers (see fig. 4) although not quite so fine in texture or so white. Corms and tubers are equally well suited for many dasheen dishes, though for a few, one or the other is preferable.

LEAVES AND LEAFSTALKS

Dasheen leaves and leafstalks (petioles) are useful as cooked greens provided care is taken to destroy the acrid element always present in the fresh state. Removal of the acridity may be accomplished by boiling the leaves 15 minutes in water to which a large pinch of baking soda has been added. The greens should then be drained, washed with clear, boiling water, and again boiled in water until tender. Prepared in this way, dasheen leaves have a food value similar to that of other greens.

Dasheen leaves may provide a valuable green vegetable for home-table use in the South in late summer and fall, especially in areas where the season is too short to raise a crop of corms and tubers. Where a tuber crop can be grown, naturally the cutting of the leaves would tend to reduce the crop; but if the leaves are picked carefully and if not too many are removed from a plant during the season, the loss in the size of the tuber crop should be relatively inconsequential. If the dasheen crop is harvested before frost, an abundance of unopened leaves may be obtained at that time without detriment to the crop. Leaves not yet unrolled or only partly unrolled (fig. 17) are more tender than the opened ones; but while the plants are growing rapidly, even the fully expanded leaves are satisfactory.

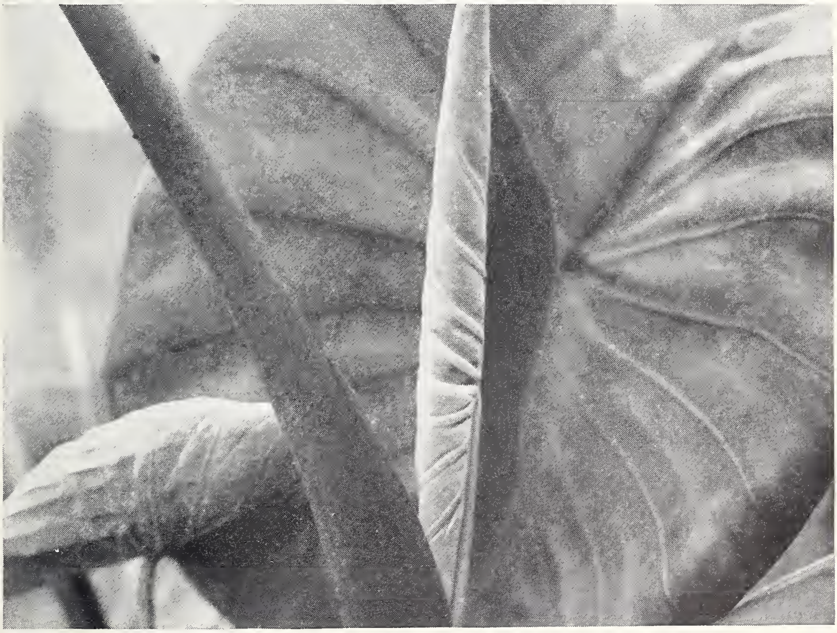

Figure 17.—Young, partly unrolled dasheen leaf at a proper stage for use as a green vegetable.

SHOOTS

Blanched dasheen shoots are prepared for the table in much the same way as the leafstalks of Swiss chard. They are obtained by forcing the corms in the dark during the winter or early spring.

In the North, two methods can be used. One is to place the corms in wet sand in a box that rests on a greenhouse bench supplied with bottom heat (fig. 18). The sprouts are blanched by being enclosed in a burlap-covered frame or merely covered with sand to exclude the light. Several cuttings may be made at 10-day intervals. The other method, suitable for production of blanched shoots on a larger scale where the weather is not too cold, is to prepare a bed for the corms under a bench without bottom heat. The space around the shoots is darkened by burlap or heavy paper. (For full particulars, see *11.*)

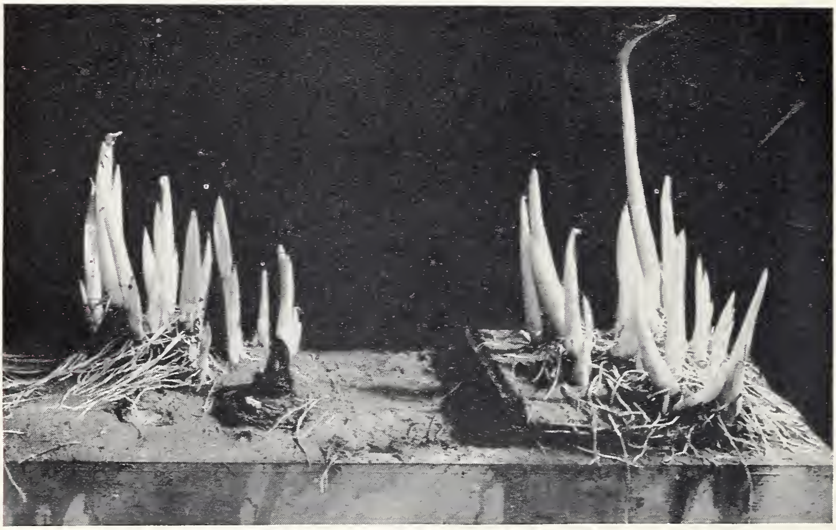

FIGURE 18.—Dasheen shoots forced in wet sand in a box with bottom heat, and blanched by being enclosed in a burlap-covered frame.

In the Deep South, the corms may be planted close together in rows in sandy soil and the shoots blanched by keeping the soil ridged above them as they grow. As much as a month may elapse after planting the corms before the first cutting of shoots can be made, but from 4 to 6 additional cuttings may be made at intervals of about 10 days.

CHEMICAL COMPOSITION AND DIGESTIBILITY

The composition of dasheens varies slightly with the variety and with circumstances, such as the soil in which they are grown, the length of time in storage, and the temperature and moisture content of the air in the place where they are stored. Differences in composition due to temperature and moisture content of surrounding air are, of course, mainly in the moisture content of the dasheen. The most rapid loss of moisture naturally occurs within the first week or two after the dasheens are dug, the rate of loss depending on the freedom of ventilation and the moisture and temperature of the air.

The chemical content of dasheens in comparison with that of potatoes and sweetpotatoes has been investigated and is set forth (table 1).

TABLE 1.—*Comparative chemical composition of raw dasheens, potatoes, and sweetpotatoes*

Crop	Water	Carbohydrates		Fat	Protein	Ash
		Total	Fiber			
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Dasheens [1]	62. 7	29. 8	0. 7	0. 2	3. 0	1. 3
Potatoes [2]	77. 8	19. 1	. 4	. 1	2. 0	1. 0
Sweetpotatoes [2]	68. 5	27. 9	1. 0	. 7	1. 8	1. 1

[1] Data from (*13*).
[2] Data from (*7*).

The starch grains of the dasheen are among the smallest found in food plants (*1*). Whether for this or some other reason, in those countries where they are commonly grown, dasheens and other taros are reputed to be more easily digested than other starchy foods.

The question of the completeness of digestibility of dasheens has been investigated (*5*) and the conclusions indicate that the digestibility of its carbohydrates compares very favorably with that of potatoes, the common vegetable most resembling the dasheen.

VALUE AS A FEED FOR LIVESTOCK

The exact value of raw dasheens as a feed for livestock is undetermined. If properly prepared, dasheen culls or those dasheens for which there is no profitable market may be fed to stock under farm conditions.

There is scientific evidence that the starch of raw dasheens, like that of potatoes, is digested with difficulty, especially when this product constitutes a large proportion of the total food of the animal. For example, it has been shown that raw dasheens, even in combination with corn, are definitely unsatisfactory for the fattening of pigs.

In general, the dasheen is deficient as a chief item of food for stock, especially when fed raw and unless an adequate supplementary amount of fat-soluble vitamin A is made available. Not only is this vitamin particularly necessary for young and growing animals, but it is important in all animal feeding. Green forage provides an excellent supplementary food supplying this constituent.

Despite the adverse evidence on the digestibility of raw dasheens, many Florida farmers who have raised dasheens and fed them in considerable quantities to livestock (usually in addition to forage and other feed) have reported very favorable results.

Horses and mules never touch raw dasheens whereas cattle, hogs, and chickens eat them with relish.

Because of its heavier yield and generally smaller tubers, the Trinidad dasheen is preferable to other varieties as a feed for stock. It is claimed that dasheens supply a longfelt need for a more starchy food for the fall and winter feeding of cattle and hogs. If turned loose in a dasheen plot in winter, cattle as well as hogs root out this food as they need it. However, this is uneconomical since numerous dasheens are left to spoil. A better practice would be to dig this food as required and to chop or slice it before feeding. Furthermore, this would tend to eliminate the danger of the animals choking, especially the cattle.

Dasheens fed to hens are usually cooked, though occasionally they are fed raw, either ground or finely cut.

It may prove profitable for stockowners who grow dasheens for use as stock feed to at least partly cook them when they are to constitute a considerable part of the ration, especially if the animals do not have access to liberal quantities of forage or other good feeds. Being too low in protein and fat for a balanced ration when used alone, especially for young animals, dasheens—even when cooked or partly cooked—should be fed in conjunction with some grain in addition to a protein supplement, such as fishmeal or tankage.

INDUSTRIAL USES

FLOUR

Dasheens, especially the corms, can be converted into a flour that is excellent for a variety of uses, as in soups and gruels, or combined with wheat or rye flour in pancakes, crullers, biscuits, and bread. Considerable interest has arisen at times over the possibility of developing an industry to produce dasheen flour, but such attempts have usually been made at too great a distance from the source of supply to afford a real opportunity for commercial success. Because of the high water content of the dasheen, only about one-fourth the original weight is obtained in flour. Therefore it would be essential to establish such a business near a center of dasheen production. No attempts, so far as is known, are under way to manufacture the flour.

In Hawaii flour is made commercially from taros (*3*). Experiments there have indicated that only the taro varieties that make good poi also make good flour.

STARCH

Because of the small size of the starch grain of the dasheen and of the mucilaginous character of the juice, the separation of the starch is rather difficult, and no satisfactory commercial method of accomplishing it has yet been worked out. Nevertheless, it has been shown that dasheen-starch paste is suitable for the sizing and finishing of textiles (*2*). In this study a comparison was made with starch pastes from potato, canna, corn, wheat, and rice. The following is quoted from (*2*).

> Fabrics seem to be stiffened both by starches having penetrating powers and by those having coating powers. Dasheen, which penetrates most thoroughly and coats the least of the starches studied, and canna, which has little penetrating power but coats very well, have stiffness values very nearly the same. In the case of dasheen the stiffness is due to the penetration of the fiber by the starch, and in the case of canna to the coating power.
>
> These facts are undoubtedly of importance both in the finishing of cotton fabrics in the mill and in the refinishing of them in the laundry. The selection

of a starch to be used depends to a large extent on the information available as to the degree of its coating and its penetrating powers. Whether or not a starch which penetrates well or one which has high coating power is chosen depends on the type and construction to be sized.

INDUSTRIAL ALCOHOL

The fermentation industry has always been interested in possible new, cheap carbohydrate sources that might serve as raw material for the production of industrial alcohol. Recently, dasheens were reported on as a possible source for industrial alcohol (*4*). In this study the dasheen was compared with the white potato and the sweetpotato (table 2). It was found that, as far as the gallonage of 95 percent alcohol produced per acre is concerned, the dasheen compares favorably with the sweetpotato and is superior to the white potato.

Table 2.—*Comparison of dasheens, sweetpotatoes, and white potatoes in alcohol yield in relation to production and composition* [1]

Crop	Production	Starch content	Protein content	Yield of 95 percent alcohol—		
				Per bushel	Per 100 pounds	Per acre
	Bushels	*Percent*	*Percent*	*Gallon*	*Gallons*	*Gallons*
Dasheens	300	26. 09	3. 00	0. 81	1. 63	243. 00
Sweetpotatoes	250	22. 80	1. 80	. 95	1. 86	247. 50
White potatoes	250	18. 90	2. 20	. 70	1. 20	175. 00

[1] Data from (*4*).

Results of the study in (*4*) indicate that if the dasheen is considered as raw material for alcohol production, it should be used in the dehydrated form; further, if dasheen utilization is to be considered for large-scale industrial alcohol production, the industry should be expanded and mechanized to increase the yield per acre and lower the price per bushel.

CHIPS

Dasheen chips, saratoga style, are made the same way as ordinary potato chips. They do not absorb as much fat as potato chips, however, and have a distinctive, nutty flavor. Only the tubers, and those of best quality and fairly large size, are satisfactory for this purpose. Attempts to use corms or low-grade tubers have resulted in an inferior product.

Commercial manufacture of dasheen chips has already been accomplished to a limited extent.

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